

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

Atty Dkt. 925-192

Wendong ZHEN

Serial No. 09/842,631

Filed: April 27, 2001

Title: SEMICONDUCTOR DEVICE HAVING FERROELECTRIC THIN FILM AND FABRICATING METHOD THEREFOR

Assistant Commissioner for Patents  
Washington, DC 20231

Group Art Unit: 2815

Examiner: Diaz, J. R.

Date: June 26, 2002



2815  
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JUL - 8 2002  
TECHNOLOGY CENTER 2800

Sir:

**RESPONSE/AMENDMENT/LETTER**

This is a response/amendment/letter in the above-identified application and includes an attachment which is hereby incorporated by reference and the signature below serves as the signature to the attachment in the absence of any other signature thereon.

**Fees are attached as calculated below:**

Total effective claims after amendment	29	minus highest number			
previously paid for	29	(at least 20) =	0	x	\$ 18.00
					\$ 0.00

Independent claims after amendment	6	minus highest number			
previously paid for	6	(at least 3) =	0	x	\$ 84.00
					\$ 0.00

If proper multiple dependent claims now added for first time, add \$280.00 (ignore improper)	\$ 0.00
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Petition is hereby made to extend the current due date so as to cover the filing date of this paper and attachment(s) (\$110.00/1 month; \$400.00/2 months; \$920.00/3 months)	\$ 110.00
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Terminal disclaimer enclosed, add \$ 110.00	\$ 0.00
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<input type="checkbox"/> First/second submission after Final Rejection pursuant to 37 CFR 1.129(a) (\$740.00)	\$ 0.00
<input type="checkbox"/> Please enter the previously unentered, filed	
<input type="checkbox"/> Submission attached	

**Subtotal \$ 110.00**

If "small entity," then enter half (1/2) of subtotal and subtract	-\$ 0.00
<input type="checkbox"/> Applicant claims "small entity" status. <input type="checkbox"/> Statement filed herewith	

Rule 56 Information Disclosure Statement Filing Fee (\$180.00)	\$ 0.00
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Assignment Recording Fee (\$40.00)	\$ 0.00
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Other:	0.00
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**TOTAL FEE ENCLOSED \$ 110.00**

The Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, in the fee(s) filed, or asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Account No. 14-1140. A duplicate copy of this sheet is attached.

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NIXON & VANDERHYE P.C.  
By Atty: Chris Comuntzis, Reg. No. 31,097

Signature: *Chris Comuntzis*

29,366

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Patent Application of

Wendong ZHEN

Serial No. 09/842,653

Filed: April 27, 2001



Atty. Ref.: 925-192

Group: 2815

Examiner: Diaz, Jose R.

*EDT-1  
Response  
#8  
7-12-02*

For: SEMICONDUCTOR DEVICE HAVING FERROELECTRIC THIN FILM AND  
FABRICATING METHOD THEREFOR

\* \* \* \* \*

Assistant Commissioner for Patents  
Washington, DC 20231

Sir:

**REQUEST FOR RECONSIDERATION**

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In response to the Office Action mailed March 1, 2002, please favorably consider the ensuing comments in conjunction with the patentability of claims 23 - 24 and 28 pending in the captioned application.

For reasons including those detailed hereinafter, Applicant respectfully submits that the Examiner has misapplied all references applied against claims 23, 24 and 28.

For example, the primary Ogata reference cited by the Examiner is essentially nothing more than what has been described in the Background portion of the present application at page 5. The Examiner correctly admits that Ogata does not teach or suggest a ferroelectric thin film wherein the crystal grain of the upper most and lower most layers are smaller than a crystal grain of the intermediate layer. Indeed, Ogata only discloses that a fine grain ferroelectric film structure is formed by coating thin Bi-compound layers 6, 8, 6a, 6b, 6c, 6d on a lower electrode 4 several times, as described in the Ogata Abstract, in order to prevent grain growth of the Bi-compound. Ogata fails to teach or suggest grain size of the Bi-compound layers.

For the teaching admittedly missing from Ogata, the Examiner mistakenly relies on Suh. However, Suh does not teach or suggest a three layer or more structure for the ferroelectric thin film disclosed and claimed in the present application. Rather, Suh merely discloses a two layer film or double layer structure film in which each layer is different in crystalline structure from the other layer. Thus, even if it would have been obvious to combine Ogata and Suh (which combination is not conceded by Applicant), Applicant's invention would not have resulted.

Considering Suh in more detail, the first STB thin film 22 formed on the bottom Pt electrode 21 is annealed at 800<sup>0</sup>C, and the second STB thin film 23 formed on the first STB thin film 22 are subjected to a rapid thermal process at 700-750<sup>0</sup>C.

The combination of Ogata and Suh would not lead to the limitation of claim 23 that a crystal grain of at least one of the lowermost layer and the uppermost layer is smaller than a crystal grain of the intermediate layer. Similarly, combination of Ogata and Suh would not lead to the limitations of claims 24 and 28. Suh does not teach the limitation of claim 28 that a crystalline nucleus density of the lowermost layer is higher than those other layers than the lowermost layer, which as obvious effects as shown in (3) and (4) of Table 1.

Notably, express objects of both Suh and Ogata differ from the claimed invention. Suh strives to decrease leakage current and breakdown voltage in a capacitor as caused by a locally thin STB layer due to a rough surface of the coarse-grain STB layer (see col. 1, lines 52 - 56 of Suh). Paragraph 0006 of the Japanese language version of Ogata states essentially the same object: decreasing leakage current and lowering breakdown voltage. For the claimed invention, on the other hand, the electrical characteristic of a ferroelectric capacitor is improved by enhancing adhesion of the ferroelectric thin film to the electrode.

The Examiner has also rejected claims 23, 24 and 28 as being anticipated or obvious over Yokoyama et al. But nowhere in Yokoyama does Applicant find a teaching or suggestion of the limitations present in the rejected claims. For example, nowhere does Yokoyama et al. teach or suggest at least a three layer structure for the ferroelectric thin film wherein the crystal gain of at least one of the lower most and upper most layers is smaller than a crystal gain of the intermediate layer. Similarly, nowhere does Yokoyama appear to teach or suggest such a ferroelectric thin film structure wherein the crystalline nucleus density of the lower most layer is higher than those of the other layers.

Thus, the cited references taken either singly or in combination do not teach or suggest Applicant's invention as recited in claims 23, 24 and 28. These claims clearly recite a three layer or more ferroelectric thin film structure with the lower most layer (or the upper most layer) having a specific relationship to the intermediate layer structure.

Applicant affirms the election of claims 23 - 24 and 28. It is respectfully requested that claims 1 - 22, 25 - 27, and 29 be retained for possible use in a subsequent divisional application.

The Commissioner is authorized to charge the undersigned's deposit account #14-1140 in whatever amount is necessary for entry of these papers and the continued pendency of the captioned application.

Should the Examiner feel that an interview with the undersigned would facilitate allowance of this application, the Examiner is encouraged to contact the undersigned.

ZHEN

Serial No. 09/842,631

Respectfully submitted,  
NIXON & VANDERHYE P.C.

June 26, 2002

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